

PATENT SPECIFICATION

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427,106

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COMPLETE SPECIFICATION.

Threads, Ribbons, Tubes and the like from Polyvinyl Compounds.

We, CONSORTIUM FÜR ELEKTRO-
CHEMISCHE INDUSTRIE G.M.B.H., a body
corporate organised according to the
laws of Germany, of 20, Zielstatt-
strasse, Munich, Germany, do hereby
declare the nature of this invention and
in what manner the same is to be per-
formed, to be particularly described and
ascertained in and by the following
statement:—

In Specifications Nos. 386161 and
393505 we have shown that threads,
cords, ribbons, tubes and the like made
from polyvinyl alcohol are quite particu-
larly suited for application to medicinal
and surgical purposes, and especially for
use for stitches and sutures in surgery.
An advantage of the polyvinyl alcohol
lies in the fact that the parent solutions
or the shaped articles therefrom are
easily sterilised, so that the threads or
the like can be obtained without diffi-
culty in a sterile form and can be used
for surgical sutures without causing
suppuration or giving rise to the forma-
tion of fistulae.

The present invention is the outcome
of further development in this field,
which has shown that there can be
obtained quite generally from polyvinyl
compounds which do not contain alco-
holic radicals or do not contain exclu-
sively alcoholic radicals, threads, cords,
ribbons, tubes and other shaped articles
which are useful for medicinal and
surgical purposes and especially as sub-
stitutes for catgut. Thus for example
threads which can be used in substitu-
tion for catgut for stitching wounds can
be obtained from esters, ethers or acetals
of polyvinyl alcohol or from the products
of the partial saponification of such
esters or acetals, also from esters of
polyacrylic acid as polyitaconic acid or
from polystyrols.

The possibility of selecting a member
of the group of polyvinyl compounds
which is especially suitable for the par-
ticular medicinal purpose in view con-
siderably extends the applicability of the
principle expressed in the aforesaid
specifications, namely, by preparing
artificial surgical threads or the like from
solutions, to attain and ensure freedom
from germs and an effective sterility of

the products and at the same time to
permit suitable modification according to
the purpose in view.

As in the case of the polyvinyl
alcohols, an internal sterility of the
article may be ensured by sterilisation
of the solution from which the article
is produced and, if necessary, by
subjecting the article also to a subse-
quent sterilisation. Thus the whole pro-
cess of manufacture, or one more of its
specific steps, may be conducted under
sterilising conditions, advantageously at
temperatures above 100° C.

The possibility of choosing products
suited to the purpose is extended by
reason of the fact that mixtures or com-
binations of different polyvinyl com-
pounds with one another or with other
substances are also useful for producing
surgical threads and the like. For ex-
ample there come into consideration
products of the reaction between poly-
vinyl acetate and sulphonic acids, such
as sulphosalicylic acid.

Although ability to be resorbed is not
desired or necessary in all cases, for
instance in a substitute for silk for
surgical purposes, it is nevertheless of
great importance that one should be in
a position to impart by suitable addi-
tions to polyvinyl compounds which are
resorbed not at all or only insufficiently
a capacity for being resorbed which can
be graded as desired by suitable selec-
tion of the magnitude of the addition.
The capacity for being resorbed of poly-
vinyl compounds which are resorbed with
difficulty can be increased by the in-
corporation of water-soluble substances
capable of being resorbed, such as
gelatine or gums, or substances such as
proteins, starch and the like which are
regarded by ferments into water-soluble
substances. Additions of electrolytes are
especially suitable for increasing the
capacity for being resorbed. Among the
large number of additions which come
into question some will now be men-
tioned. For example organic acids such
as oxalic acid, malic acid or lactic acid
are active and especially those acids
which are substituted by negative or
positive radicals. Thus sulpho-salicylic
acid, benzene sulphonic acid, toluene

[Price 1s.]

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sulphonic acid, trichlor-acetic acid, glyccoll and asparaginic acid are very active. Phenyl-hydrazine hydrochloride is also very active. Inorganic electrolytes such as borax, nickel nitrate, potassium bichromate and others also improve the capacity for being resorbed.

In order to promote the resorption of, for instance, polyvinyl acetate there may be added to it sulpho-salicylic acid or benzene sulphonic acid. Resorption of polyacrylic acid esters can be promoted by addition of sulpho-salicylic acid. In general an addition amounting to a few per cents, for example 5-10 per cent, is sufficient. The capacity for being resorbed can be graded as required by the magnitude of the addition. If the capacity for being resorbed is too great, the quantity of the addition is diminished and *vice versa*. The substances which promote resorption, as well as the further additions hereinafter to be referred to, can be added under suitable circumstances to the parent material serving for the production of the polyvinyl compound. For example, if threads of partially esterified or acetalised polyvinyl alcohol are to be made by spinning a solution of an ester or acetal and subsequently saponifying the threads thus obtained, the additional substances may if required be incorporated in the solution which is to be spun.

In case of necessity the strength of the threads and the like from polyvinyl compounds can also be suitably increased. This object may be attained, for example, by the addition of suitable electrolytes, among which there may be named particularly sulphocyno compounds, such as potassium sulphocyanide or ammonium sulphocyanide. An addition of a sugar, such as cane sugar, also produces a very considerable increase in strength. Additions of about 5-10 per cent suffice, but obviously the quantity can be varied according to requirements and to the desired result.

There also comes into consideration the addition of substances having a bactericidal action. Any bactericidal substance which is compatible with the polyvinyl compound is suitable. From the large number of bactericidal substances of various groups there may be mentioned by way of example esters of aromatic acids, such as propyl benzoate, also salts, compounds or sols of metals such as silver, mercury, bismuth, arsenic and others. Sulphur compounds and other substances having a bactericidal action also come into consideration.

For example, threads of polyvinyl acetate acquire strong bactericidal pro-

perties when there is incorporated in them propyl benzoate or mercuric chloride. Even small quantities of these additions generally suffice, depending on their bactericidal action.

There may also be incorporated in the threads therapeutically active substances, for example, substances promoting granulation, such as a silver salt or an iodine preparation, substances having a vasomotor action, such as adrenaline, substances having an astringent or styptic action such as a tanning agent or ferric chloride, tinctures, drugs of any kind, alkaloids, antitoxins, sera, radioactive preparations and so on.

The formed articles in accordance with the invention are mainly of importance in the sphere of surgery. However, the possibility of producing them with a desired capacity for being resorbed and with desired therapeutically active additions also renders them useful, in the form of capsules, pills, plugs and the like, for other medicinal purposes.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A manufacture of threads, cords, ribbons, tubes and other articles, wherein these articles are made from a polyvinyl compound which contains no alcoholic radicals or does not contain exclusively alcoholic radicals, or from a mixture or combination of such compounds with one another or with other substances, for medicinal and especially for surgical purposes, for instance, as substitutes for catgut, silk, twine, horsehair and other surgical materials for sutures.

2. A manufacture as defined in claim 1, wherein the whole process of manufacturing or one or more of its specific steps are carried out under sterilising conditions advantageously at temperatures above 100°C.

3. Threads, cords, ribbons, tubes and other articles made by the manufacture defined in claim 1 or claim 2.

4. Threads, cords, ribbons, tubes and the like as defined in claim 3, containing a substance which promotes resorption, substantially as herein described.

5. Threads, cords, ribbons, tubes and the like as defined in claim 4, containing an electrolyte as a substance which promotes resorption.

6. Threads, cords, ribbons, tubes and the like as defined in claim 3, 4 or 5, containing a substance which increases their strength, substantially as herein described.

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7. Threads, cords, ribbons, tubes and the like as defined in claim 3, 4, 5 or 6 containing a substance having a bacteriocidal or therapeutic action. as defined in Claim 8 and containing also a substance referred to in any of Claims 4-7.
- 5 8. Plugs, pills, capsules and the like made by the manufacture defined in claim 1 or claim 2 and containing or enclosing a therapeutically active substance. Dated this 16th day of October, 1933.
- 10 9. Plugs, pills, capsules and the like
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